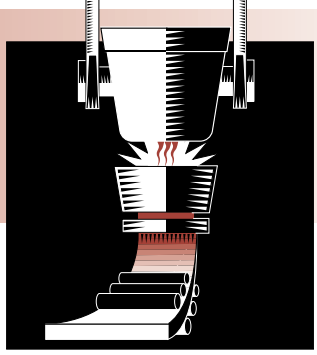
STEEL

Project Fact Sheet



Development and Demonstration of Novel Low-NO_x Burners for Boilers in the Steel Industry

Benefits

- Redu ced NO_x emissions by more than 13,000 tons per year
- Increased energy savings of up to 2.5 trillion Btu per year
- Increased boiler energy efficiency
- Maintain carbon monoxide (CO) emissions at 50 ppm or less
- Assure total hydrocarbons do not exceed 50 ppm
- Energy savings from use of by-product gas

Applications

FIR burners can bring NO_x levels down below 15 ppm by combining advanced burner geometry and combustion staging with control strategies tailored to mixtures of natural gas and by-product fuel gases. These methods can reduce all varieties of NO_x: thermal NO_x produced by high flame temperatures, prompt NO_xproduced by complex chain reactions involving radical hydrocarbon species, and NO_x from fuel-bound nitrogen compounds such as ammonia found in coke oven gas.

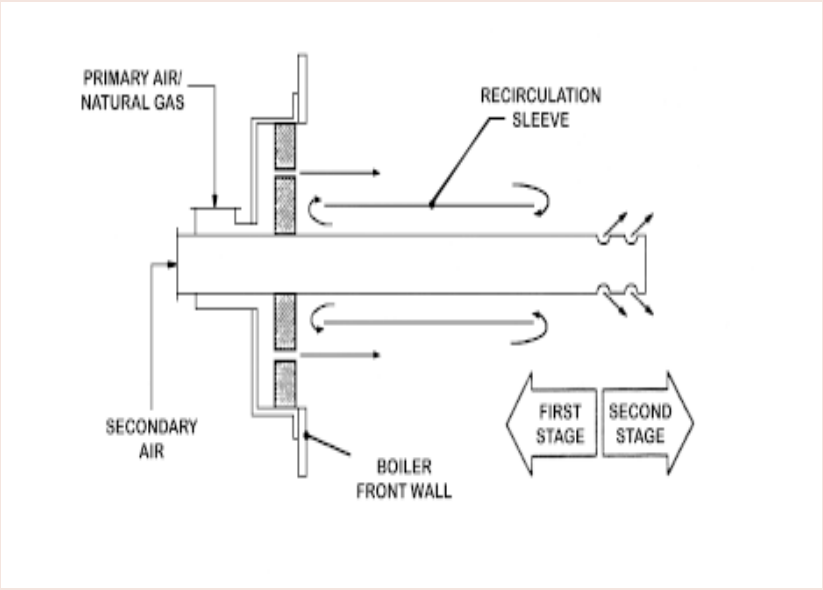
Novel burner design results in low NO_x emission with by-product gases

The steel industry has long used by-product coke oven gas (COG) and blast furnace gas (BFG) as a means of reducing its energy costs. However, these fuels produce nitogen oxide (NO_x) emission levels greater than would be predicted from their Brithish thermal units (Btu) content, in part due to the presence of nitrogen-containing compounds.

NO_x reduction is a key environmental goal for the steel industry. This is particularly true for facilities located in non-attainment air quality regions. The forced internal recirculation (FIR) burner technology should lower NO_x emissions below 15 ppm even when fueled by mixtures of by-product gases, COG, BFG, and natural gas. The technology is designed to allow boilers to reach low emissions levels without the energy penalties associated with other NO_x reduction technologies.

The benefit of the FIR burner technology is that it can reduce these emissions at minimum excess air conditions. This will result in higher boiler efficiency and assure that by-product gas remains an industry fuel, displacing natural gas, thereby reducing industry energy costs. This project builds upon prior Office of Industrial Technologies (OIT)-sponsored research at the Gas Technolgy Institute (GTI) and the University of Utah.

FIR Burner



The basic concept of GTI's FIR burner.

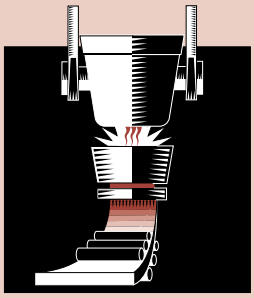
Project Description

Goal: Demonstrate a large prototype FIR burner (40 to 60 x 10^6 Btu per hour) technology at industrial steel mills using combinations of by-product gas and natural gas.

The project objectives are summarized as follows: 1) Develop a version of the FIR burner that can fire at 6 x 10^6 Btu per hour combinations of BFG, COG, and natural gas and achieve less than 15 ppm NO_x along with less than 50 ppm of CO and hydrocarbons at a turndown of 4-to-1; 2) Develop a combined chemistry and computational fluid dynamics (CFD) model that can be used for scale-up design of low-NO_x FIR burners as described above; and 3) Demonstrate an industrial prototype burner system (40-to-60 x 10^6 Btu per hour) on a boiler at an operating steel mill, including long-term operation for a three-month period.

Progress and Milestones

- Project start date, September 1999.
- Laboratory tests are underway at GTI.
- Complete laboratory testing and development of 6 x 10^6 Btu per hour FIR burner in 2001.
- Complete demonstration industrial prototype in 2002.
- Project completion date, September 2002.



Project Partners

Gas Technology Institute
Des Plaines, IL

Covol Technologies
Lehl, UT

Detroit Stoker Company
Monroe, MI

University of Utah
Salt Lake City, UT

For additional information, please contact:

Gideon Varga
Office of Industrial Technologies
Phone: (202) 586-0082
Fax: (202) 586-7114
gideon.varga@ee.doe.gov
http://www.oit.doe.gov/sens_cont
http://www.oit.doe.gov/steel

Please send any comments, questions, or suggestions to webmaster.oit@ee.doe.gov.

Visit our home page at www.oit.doe.gov

Office of Industrial Technologies
Energy Efficiency
and Renewable Energy
U.S. Department of Energy
Washington, D.C. 20585

OIT

May 2001